

CLAIMS

The embodiment of the invention in which an exclusive property or privilege is claimed is defined as follows:

1 1. A process for removing uranium from nuclear fuel contained in an
2 electrorefiner, the process comprising:

3 a) oxidizing the uranium to create positively charged uranium ions;
4 b) depositing the ions onto a cathode as uranium metal;
5 c) reoxidizing a portion of the deposited uranium metal so as to cause
6 the reoxidized portion to separate from the cathode;
7 d) removing the uranium metal from the cathode; and
8 e) redepositing the reoxidized portion onto the cathode as uranium
9 metal.

1 2. The process as recited in claim 1 wherein the step of oxidizing the
2 uranium further comprises contacting the nuclear fuel to a first charged anode.

1 3. The process as recited in claim 1 wherein the step of reoxidizing a
2 portion of the deposited uranium metal further comprises subjecting the deposited
3 uranium metal to U^{+4} .

1 4. The process as recited in claim 1 wherein the U^{+4} is produced by
2 contacting U^{+3} to a second charged anode.

1 5. The process as recited in claim 4 wherein a first voltage potential
2 exists between the cathode and the first charged anode and a second voltage
3 potential exists between the cathode and the second charged anode.

1 6. The process as recited in claim 5 wherein the first voltage potential
2 and the second voltage potential are different.

1 7. The process as recited in claim 5 wherein the absolute value of the first
2 voltage potential is less than the absolute value of the second voltage potential.

1 8. The process as recited in claim 4 wherein the second anode is closer
2 to the cathode than to the first anode.

1 9. The process as recited in claim 5 wherein the production of U^{+4} occurs
2 when the second voltage potential is higher than the first voltage potential.

1 10. An improved electrorefiner cell, the improvement comprising a means
2 for oxidizing U^{+3} to U^{+4} .

1 11. The electrorefiner cell as recited in claim 10 further comprising:
2 a) a first anode;
3 b) a cathode separated from the first anode a first distance; and
4 c) a second anode separated from the cathode a second distance, the
5 second distance equal to the first distance.

1 12. The electrorefiner cell as recited in claim 11 wherein the second
2 anode is the means for oxidizing U^{+3} to U^{+4} .

1 13. The electrorefiner cell as recited in claim 11 further comprising a
2 means for establishing a first voltage between the cathode and the first anode and
3 further comprising a means for establishing a second voltage between the cathode
4 and the second anode.

1 14. The electrorefiner cell as recited in claim 11 wherein the number of
2 first anodes are the same as the number of second anodes and the first anodes are
3 separated by the second anodes.

1 15. The device as recited in claim 11 wherein the second anode is
2 comprised of an alloy of 70 % (wt.) molybdenum (Mo) and 30 % (wt.) tungsten (W),
3 molybdenum, and tungsten.

1 16. The device as recited in claim 11 wherein the two anodes are in
2 separate electrical communication with the cathode via ionic transport.

1 17. The device as recited in claim 11 wherein the size of the second
2 anodes are independent of the sizes of the cathodes and the first anodes.

1 18. The device as recited in claim 11 wherein the second anode is rigidly
2 attached to, and electrically insulated from, the first anode.